IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant(s): Crabtree, et al. Application No.: 09/593,360 Filed: 6/14/2000 Title: (Ranger CIP) System for Automatic Self-Proportioning of Foam Concentrate into Fire Fighting Fluid Variable Flow Conduit Attorney Docket No.: 0110SS-44500	Group Art Unit: 3752 Examiner: C. Kim

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Commissioner for Patents
P. O. Box 1450
Alexandria, VA 22313-1450

APPEAL BRIEF

(1) **Real party in interest.** The real party in interest is Williams Fire and Hazard Control, Inc., a Texas Corporation, which is the assignee of all rights from the three inventors, Dwight Williams, Dennis Crabtree and Dwayne Brinkerhoff.

(2) **Related appeals and interferences.** There are no related appeals or interferences, to Applicant's attorney's best knowledge, that would directly affect, or be directly affected by, or have a bearing on , the Board's decision in the pending appeal.

(3) **Status of the claims.** Claims 1-44 are pending in the application. (Applicant actually has regarded claim 40 as cancelled since it was not included in the substitute claims submitted with the RCE and its limitation has been incorporated into claim 39. Applicant will request cancellation of claim 40 as soon as such is expeditious and appropriate.) Claims 1-11, 19, 21-38 and 44 were withdrawn by the Examiner from consideration, under traverse, and subject to applicant's right to file continuations, and divisionals or the like, and also subject to additional claims being allowable in light of generic claims allowed.

Thirteen (13) claims, thus, are presently pending and under appeal: claims 12-18, 20, 39 - 43. All claims are method claims and stand rejected under reference Klein. The independent claims are claims 12, 14, 20, 39 and 42. See Appendix A containing a copy of the claims involved in the appeal and the withdrawn claims.

(4) **Status of Amendments.** There is no amendment that has not been entered.

(5) **Summary of the Invention.**

In General

The invention is directed to methods for proportioning a fire fighting concentrate (usually a foam concentrate) into a <u>variably</u> flowing fire fighting fluid (usually water) in a conduit. (See page 1, lines 15-20; page 8, lines 15-16.) Fire fighting fluid is usually "water" (page 21, lines 19-23) and may be referred to hereinafter as water, for simplicity. The conduit is usually a hose, line, pipe or nozzle. The fire fighting concentrate, usually a "foam" concentrate, is also referred to in the industry as a "foaming concentrate" or a "concentrate" or a "foam", which terms may be used interchangeably hereinafter. (See page 21, lines 19-23.) In general, the concentrate may be "educted" into a line (or conduit or nozzle or the like), in whole or in part, or may be otherwise pressured or pumped into a line (page 23, lines 4-6,) or both.

Note – Caveat – Important

The words "proportioning" and "metering" are used in the industry, sometimes indiscriminately, to refer to **two different problems** encountered while introducing a concentrate into flowing fire fighting fluid line.

The **first** problem, the problem addressed by **the instant application**, is that of introducing the right amount of concentrate when the flowing fluid (or water) **has a variable flow rate**. The objective is to keep the concentrate-to-fluid (or to-water) ratio as per manufacturer's specifications. E.g. concentrates usually come in large drums as a "1%", 3%, 6% or possibly a "10%" concentrate. That means that they need to be mixed with the fluid (or water) in a 1 part to 99 parts ratio, or a 3 parts to 97 parts ratio, or a 6 parts to 94 parts ratio or a 10 parts to 90 parts ratio. The instant invention assumes one is working with some one of such drums. The problem addressed is what to do when the water flow rate varies significantly.

The **second** problem, reference **Klein's** problem, is that of **switching between different sources of concentrate** during one job, each source having a different level of concentration, and thus each requiring a different proportioning ratio to the water. E.g. how to effectively switch from a "3% concentrate" to a "1% concentrate" or to a "6% concentrate" during a fire. This <u>is</u> a real issue, and it is variously solved by various techniques in the industry. Klein proposes one solution. The problem typically is caused by the fact that, in an emergency, one borrows foam concentrate from one's neighbors. Borrowed foam concentrate is likely to be at a different level of concentration than one's own. **Caveat:** This is <u>not</u> the problem addressed by the <u>instant</u> application.

The instant invention offers a novel and improved solution to the **first** problem above. Primary reference Klein offers a solution to the **second** problem above. Neither address the

other's problem. So, in summary, there are **two** "foam proportioning" or "foam metering" problems, which should be distinguished and not confused: (1) the "variable (water) flow rate problem"; and (2) the "variable degree of concentration problem". Again, it is important not to confuse between them, although both use the word "proportioning" and/or "metering". Keeping these matters distinct helps to understand why Klein is not teaching or suggesting Applicant's invention. E.g. Klein is addressing a different problem.

More Re Instant Invention, In Particular

In addressing the first problem, the "variable water flow rate proportioning problem", Applicant does not discuss what happens when drums with different levels of concentration are interchanged. (Applicant does have means to deal with this problem, but for the sake of convenience or simplicity in the instant application assumes one level of concentration. Said otherwise, Applicant does not discuss its means for dealing with switching between drums with different levels of concentration.) The problem Applicant addresses is mixing the right amount of concentrate (i.e. concentrate at a rate of 1 part concentrate per X parts water, whatever that X may be) into a flowing water line when (as and while) the flow rate (gpm) of the water through the line itself significantly varies. (Page 7, lines 12-14; page 21, lines 10-11.) This significant variation in particular may occur when one tries to maintain a constant pressure discharge in a fire fighting nozzle. It may also occur in any conduit due to a significant variation in upstream supply and/or downstream demand.

Note: some fire fighting nozzles do not have a significant flow rate variation. E.g. firefighting nozzles that allow discharge pressure to vary while keeping flow rate relatively constant, by utilizing fixed discharge outlets (and that can count upon a somewhat close to nominal supply pressure), ameliorate and can largely ignore this first problem. Note: by providing a fixed discharge outlet, flow rate tends to vary only as the square root of supply pressure. (Other systems may largely alleviate supply and demand variations through interposing pumps or the like in the line.)

There is, however, a significant and growing use for fire fighting nozzles that discharge at a constant pressure. Such nozzles do allow flow rate to vary, likely significantly, in maintaining the constant discharge pressure, allowing the discharge outlet size and the gpm to vary with supply pressure. These nozzles encounter the first problem. Furthermore, in some conduits, pipes or lines, "inline" proportioning systems utilize a pressure drop to introduce into the line a foam concentrate. Flow rate in these conduits also may significantly vary. Appropriately controlling of the pressure drop, therefore, can significantly heighten efficiency.

Whether in a nozzle (Figures 3A, 3D, 10A, 10B,) or a conduit (Figures 11A-11H,) the instant invention pertains to methods for proportioning fire fighting concentrate into a variably flowing fluid line in order efficiently maintain the desired concentration ratio. (See page 8, lines 16-17.) Appreciation of the problem, as well as the possibility of, the existence of and the value of a solution, comprises part of the instant invention.

A pilot valve sensitive to fluid flow rate may be utilized in the instant invention, which pilot valve may assist to regulate fluid flow rate and regulate concentrate flow. (See page 22, lines 7-12, 16-20.)

(6) **Issues.**

§ 112 issue.

Issue 1: whether the specification enables "a fixed pressure drop"; and even if the pilot valve produces a fixed pressure drop depending on the fluid flow, whether "a range of pre-selectable pressure drops" is disclosed in the specification.

§ 102 and § 103 issues.

Issue 2 and 3 – In General: whether Klein anticipates claims 12-18, 39, 41 and 43, and/or renders obvious claims 20 and 42, and in particular, whether the Examiner has made a *prima facie* case with respect to all elements of each independent claim.

Issues 2 and 3 – In Particular (Nothwithstanding the above):

Issues 2 and 3 – Sub-Issue A: whether Klein discloses, or teaches or enables, proportioning a chemical (or foam or foam concentrate) into a **variably** flowing fluid, as per claims 12, 14 and 39; or adjusting… as fire fighting fluid **varies**, as per claim 12; or adapting a pilot valve… such that foam concentrate is proportionally metered into a **variably** flowing fluid, as per claim 39. To summarize Sub-Issue A, does Klein even address metering concentrate into a fluid having a **variable** flow rate?

Issue 2 and 3 – Sub-Issue B: whether Klein discloses:

(1) "**adjusting** a firefighting fluid orifice in a fire fighting fluid conduit **to maintain a predetermined pressure drop** across the orifice as fire fighting fluid flow rate through the conduit varies; " as in claim 12;

(2) "**varying** a fire fighting fluid orifice in a conduit **to maintain a preselected pressure drop** in the conduit", as in claim 14;

(3) "automatically **adjusting** a firefighting nozzle **to control discharge pressure**;" as in claim 20;

(4) "**varying** the obstruction by the pilot valve **to maintain a fixed pressure drop** in the fire fighting fluid conduit", as in claim 39;

(5) "automatically **adjusting** an obstruction in a fire fighting fluid conduit flowing at least 500 gpm **to maintain a preselected pressure drop**", as in claim 42.

To summarize Sub-Issue B, does Klein disclose, address or enable adjusting (or varying) an orifice (or obstruction or nozzle) <u>to</u> <u>maintain</u> <u>a</u> <u>predetermined</u> (or preselected or fixed) <u>pressure drop</u>, as per claims 12, 14, 39 and 42?

Issues 2 and 3 – <u>Sub-Issue C</u>: does Klein teach, suggest or enable **automatically** varying a foam proportioning orifice in order to meter **in accordance with flow rate**, as per claim 20?

Issues 2 and 3 – <u>Sub-Issue D</u>: does Klein teach or suggest **automatically** adjusting... **to control discharge pressure** (or pressure drop), as per claims 20 and 42?

Issues 2 and 3 – <u>Sub-Issue E</u>: does Klein disclose that a varying fire fighting fluid orifice **acts as a fire fighting fluid flow rate indicator**, as per claim 14?

Issue 3 - <u>Sub-Issue F</u>: whether it would have been obvious to use the "valve" taught by Klein as a "terminal member" (e.g. and thus as a "fire fighting nozzle",) as recited in claim 20?

(7) **Grouping of the Claims.**

The independent claims are 12, 14, 20, 39 and 42.

Claims 16 and 17 stand and fall together re Issue 1.

Claims 12, 14, 20, 39 and 42 stand and fall separately in regard to failure to make a *prima facie* case, in general.

Claims 12, 14 and 39 will be deemed to stand and fall together for purposes of this appeal in regard to Sub-Issue A.

Claims 12, 14, 20, 39 and 42 will be deemed to stand and fall together for purposes of this appeal in re Sub-Issue B.

Claim 20 is argued separately in re Sub-Issue C.

Claim 20 and 42 will be deemed to stand and fall together in re Sub-Issue D.

Claims 14 is argued separately in re Sub-Issue E.

Claim 20 is argued separately in re Sub-Issue F.

In re the Section 102 and 103 issues, including Sub-Issues A-F, the dependent claims, that is claims 13, 15, 16, 17, 18, 41 and 43, will be deemed to stand and fall with the independent claims upon which they depend, for purposes of this appeal.

(8) **Argument.**

<u>Further Preliminary Remarks re Klein</u>

Based upon the Examiner's remarks in the 4th Office Action, mailed 8/2/02, paragraph 8, Klein will be divided into two stages for discussion purposes herein. In Stage I, the Primary Operating Stage, the displacement limiting pin 62 (or the like) is bottomed out in the downstream end of slot 60. Klein's piston, at all relevant times during pump flow in Stage I, remains fixed in this preselected proportioning position. See Klein '956, col. 7, lines 12-17. For Klein's adjustable proportioning valve 10 to function, this operator-preset maximum piston displacement position, which corresponds to the proper percentage mixture of secondary fluid to primary fluid, is determined either by engagement of a displacement limiting pin 62 set by the operator against a downstream end of slot 60 or engagement of a shoulder 74 on tubular stem 32 against an upstream end of piston slide support 24, or the like. Klein teaches that his proportioning valve only works for its intended purpose in this Primary Operating Stage I. See col. 7, line 12-25.

In a Brief, Transitory Opening and Closing Stage II, refering to the brief and transitory period of time at the beginning or end of an operation, when piston 32 is moved from its closed position to its open position, or vice-versa, Klein contains no teaching that his proportioning valve operates for its, or any other, intended purpose. Applicant submits that this Opening and Closing Stage is so brief, transitory and ignored by Klein as to be legally insignificant. Nonetheless, because at one point the Examiner relied upon it, mentioning it is included.

Issue 1 – Whether the specification enables "a fixed pressure drop", as recited in claim 16; and even if the pilot valve produces a fixed pressure drop dependent on the fluid flow, whether the specification discloses a "range of pre-selectable fixed pressure drops."

Claim 16 was an original claim. Teachings related to claim 16 can be found in the specification, among other places on page 25, line 27, to page 27, line 24 discussing Figures 11. In particular, see page 26, lines 3-4 and 19-24, see page 27, lines 1-2, 13-14 and 17-19, in regard to a fixed pressure drop. See also original apparatus claims 21-23, 33-36 and original method claims 24-26.

In regard to the range of preselectable fixed pressure drops, one of ordinary skill in the art, knowledgeable of pilot valves, would know that a spring SP in a pilot valve can determine the setting of the pilot valve and that pilot valves can come with an option of springs or setting mechanisms, allowing the pilot valve to be set at various targeted trigger valves. The selection of an appropriate pilot valve spring or the like setting of the pilot valve can select a pressure differential to be maintained. The selection of a pilot valve spring can be used to target a particular pressure drop in the conduit.

The specification, together with the knowledge expected of one of ordinary skill in the art, including knowledge of pilot valves, enables selecting a pilot valve spring and setting a pilot valve to maintain a desired fixed pressure drop across an orifice and to select a targeted pressure drop from among a range of pre-selectable pressure drops.

Issue 2 and 3 – In General: whether Klein anticipates claims 12-18, 39, 41 and 43 or renders obvious claims 20 and 42, and in particular whether the Examiner has made a *prima facie* case with respect to all elements of each independent claim.

Independent claims 12, 14 and 39 were rejected under 102(b) as anticipated by Klein '956. Applicant submits that the Examiner has the burden to establish a *prima facie* case of unpatentability of the pending claims on any grounds, including anticipation and obviousness. *In re Oetiker*, 24 U.S.P. 2d 1443, 1444 (Fed. Cir. 1992). If examination at the initial stage does not produce a *prima facie* case of unpatentability, then without more, the applicant is entitled to grant of the patent. *In re Oetiker*, 24 U.S.P.Q.2d 1443, 1444. In order to establish a case of *prima facie* anticipation, the examiner must establish that each and every element as set forth in the claims is found, expressly or inherently described, in a single prior art reference. MPEP 2131.

Applicant respectfully submits that it has not been established that every element of the above independent claims is found in, or is inherently described in, Klein. A prima facie case, thus, has not been made. Without more, applicant is entitled to grant.

More particularly, regarding claim 12: the Examiner has not asserted or established that "adjusting a fire fighting fluid orifice in a fire fighting fluid conduit to maintain a predetermined pressure drop across the orifice as fire fighting fluid flow rate through the conduit varies" is found in, or inherently described in, Klein. Likewise, the Examiner has not asserted or established that "varying a fire fighting fluid orifice to maintain a preselected pressure drop in the conduit" is found in, or inherently described in, Klein. (Applicant draws the Examiner's attention to the teaching and disclosure of column 7 of Klein. In particular, see lines 12 through 17 of column 7.) Klein does not teach or suggest adjusting a fire fighting fluid orifice to maintain a predetermined pressure drop across the orifice as fire fighting fluid flow rate varies, and/or varying a fire fighting fluid orifice to maintain a preselected pressure drop.

Klein teaches a check valve. In regard to Klein Stage II and "inherently," when an upstream valve, such as a deluge valve, is opened, water pours through Klein's conduit, hitting Klein's check valve and moving it to its full opened position. Klein repeatedly asserts that Klein's check valve piston is "lightly biased" by a spring; see column 2 line 67 and column 8 line 33, for instance. One of skill in the art would anticipate, therefore, that the time period for Klein's check

valve to open should be a very small fraction of a second. During that time period, in which Klein's check valve moves from closed to open, hydraulic conditions, or flow through the valve, will be turbulent, unstable, characterized by cavitation and affected by forces of friction and inertia. One of skill in the art would believe that there is no accurate "model" to describe fluid flow through the check valve during the short unstable transient period of the opening. Considering no more than the turbulence of the leading edge of the water and the effect of the air pressure in the pipe or the line, there is no reason to believe that the relative degree of openness of the orifice would be a reliable indicator of the rate of fluid flow through the orifice during that period. Klein does not teach that the degree of openness of his check valve during the transient opening period bears any correlation with fluid flow rate through the orifice. The impediments to such knowledge include the transitoriness of the effect and the instability of the forces in operation.

Applicant respectfully submits that the Examiner's "inherency-type" argument in regard to claim 14 and 39, therefore, fails. Per claim 14, the Examiner has not shown that it is inherent in Klein that during the opening of Klein's check valve the varying orifice acts as a fire fighting fluid flow rate indicator. In regard to claim 39 the Examiner has not shown that Klein inherently teaches foam concentrate "proportionally metered" into the fire fighting fluid (wherein "proportionally metered" is understood in the sense of the proportional metering problem of the instant application, that is proportionally metered taking into account varying fire fighting fluid flow rate through the conduit.)

In regard to claim 39, the Examiner does not assert or establish that "arranging a pilot valve sensitive to flow rate of the fire fighting fluid in the conduit" is found in, or is inherently described in, Klein. Applicant submits that Klein's check valve is sensitive to flow, in the sense of "on" or "off", but Klein does not teach or suggest a pilot valve sensitive to flow rate. The Examiner does affirmatively assert that in Klein "measuring pressure drop is accomplished since the degree to which opening 54 is opened depends on the pressure drop across element 36". Applicant respectfully traverses and submits that such is not taught by Klein. (Again, see column 7, lines 12-17.) The degree to which opening 54 is opened depends on the prior setting of the "pins" or the like. "Pin setting" is selected to correspond to the density, or percent concentrate, of the foam additive to be utilized. (Note that figure 5 shows Klein's valve in its closed position, while Figure 6 shows Klein's valve in an actuated open position.) As per Klein, the degree to which opening 54 is opened depends on the adjustable pin and slot means for adjusting the actual extent of displacement of the piston in 32 and hence adjusting the extent of registry of the valve

stem apertures 54 with the secondary fluid points 28 when the valve is actuated by a flow of primary fluid there through. (See column 5 line 67 through column 6 line 6.) Such adjustment, illustrated particularly in figures 2, 7, 8 and 9, is referred to as "an important aspect" of the Klein invention. A pin mounting hole is to be provided for each preselectable ratio of secondary/primary fluid mixture proportions. (See column 6 lines 20 through 23.) Figures 10-13 and 14-17 show alternate embodiments, all analogous to the above-preselected pin and slot arrangement. Note further in Klein's Abstract of the Invention that the extent of displacement of a flow displacing proportioning piston (element 36 creating orifice 54) is preselected by engagement of an adjustable stop member in one of a plurality of specific stop positions. In summary, Klein neither teaches nor suggests that the degree to which 54 is opened depends on any pressure drop across element 36, as the Examiner asserts.

Re claim 20, rejected under § 103(a) as unpatentable over Klein, it is asserted that Klein "discloses the limitations of the claimed invention" with the exception of the nozzle and the flow rate range. Applicant traverses and submits that the Examiner does not assert or establish a teaching or suggestion in Klein for the claim elements of:

"automatically adjusting a fire fighting nozzle to control discharge pressure;" and/or

"automatically varying a foam proportioning orifice to meter foam concentrate self-educted into the nozzle in accordance with fire fighting fluid flow rate through the nozzle." Applicant submits that Klein neither mentions a pressure drop around the obstruction nor teaches varying the obstruction 36 by the pilot valve to maintain a fixed pressure drop in the fire fighting fluid conduit. Similar arguments apply to claim 42.

Since the Examiner has failed to establish a prima facie case of unpatentability of the independent claims, applicant is entitled to grant. Further discussion is unnecessary under the circumstances.

Issues 2 and 3 – In Particular (Nothwithstanding the above).

Issues 2 and 3 – Sub-Issue A: whether Klein discloses proportioning a chemical (or foam or foam concentrate) into a <u>variably</u> flowing fluid, as per claims 12, 14 and 39; or adjusting... <u>as</u> fire fighting fluid <u>varies</u>, as per claim 12; or adapting a pilot valve... such that foam concentrate is proportionally metered into a <u>variably</u> flowing fluid as per claim 39. To summarize Sub-Issue A, does Klein address or enable metering concentrate into a fluid having a <u>variable</u> flow rate?

Klein does not teach, disclose, discuss, suggest or enable proportioning a chemical (or foam or foam concentrate) into a "**variably**" flowing fluid, as per claims 12, 14 and 39. Klein

does not teach, suggest, disclose, discuss or enable adapting a pilot valve such that foam concentrate is proportionally metered into a "**variably**" flowing fluid, as per claim 39.

In Klein's Primary Operating Mode Stage I, with the piston bottomed out, Klein neither mentions nor discusses what to do if the a fluid has a significantly **variable** flow rate. Klein does not acknowledge that the problem exists. Klein teaches neither a solution nor an adjustment to accommodate a "variable" flow rate of the fluid, if one were to occur. One must assume that Klein is dealing with a situation in which there is no significant variation of fluid flow rate for the primary fluid. In part this may be due to the fact that Klein proposes that his valve be placed on the suction or pressure side of a pump.

During start-up, the during Brief, Transitory Opening and Closing Stage II, identified above, one can assume that flow rate in Klein's valve varies. However, Klein has no teachings in regard to proper or controlled proportioning of chemical into the fluid during this stage nor in regard to adapting a pilot valve such that foam concentrate is properly proportionally metered into the varying fluid during this unstable brief transition stage.

Issues 2 and 3, Sub-Issue B: whether Klein discloses "adjusting a fire fighting orifice... to maintain a predetermined pressure drop across the orifice...", as found in claim 12;

or

whether Klein discloses "varying a fire fighting fluid orifice... to maintain a preselected pressure drop in the conduit", as recited in claim 14;

or

whether Klein discloses "adjusting... to control discharge pressure", as recited in claim 20;

or

whether Klein discloses, "varying the obstruction by the pilot valve to maintain a fixed pressure drop in the fire fighting conduit", as per claim 39;

or

whether Klein discloses "adjusting an obstruction in a fire fighting fluid conduit...to maintain a preselected pressure drop", as per claim 42?

To summarize Sub-Issue B, does Klein disclose, address or enable adjusting (or varying) an orifice (or obstruction or nozzle) <u>to</u> <u>maintain</u> <u>a</u> <u>predetermined</u> (or preselected or fixed) <u>pressure</u> <u>drop</u>, as per claims 12, 14, 39 and 42?

Klein's piston, in its operating position, bottoms out at the stop preselected by the operator to correspond to the level of concentration of the additive product being used. Klein's variable orifice when bottomed out does not adjust in accordance with varying fire fighting fluid flow rate. Klein does not teach or suggest, and in fact teaches away from, varying an orifice or the like to maintain a preselected pressure drop.

Looked at alternately, Klein's invention requires the piston to move to a full open or bottomed out position in order to properly perform its metering function for different concentrate ratios, dictated by different concentrate products. See Klein, col 7. "The piston return spring 38 is a sufficiently weak spring so that with any amount of pump flow the displacement limiting pin 62 will always bottom out … . " Klein, Col. 7, line 10 – 14. "[T]he piston is lightly biased by a spring toward the upstream direction to a closed unactuated position of the valve … . Mainstream fluid flow through the valve body shifts the piston to a preselected actuated position wherein the piston is stopped … . The stop position of the piston is determined by the position of an adjustable stop member … , the stop member being adjustable to any one of a plurality of specific stop positions which case the piston to stop at respective discrete predetermined positions." Klein, col 2, line 66 – col. 3 line 18. So were Klein's spring to maintain some constant intermediate position during relevant flow (and thus did **not** bottom out on a preselected stop calibrated to meter at a given ratio, that is, if Klein's spring maintained the piston 36 in some constant indeterminate position) **then** the situation would be indistinguishable from Klein's device "bottoming out" at a **different** stop position. In **such** case, i.e. "bottoming out" on a <u>different</u> position than the stop position preselected by the operator, would cause Klein's valve to be **mal**functioning. It would <u>not</u> be working for its intended purpose. Klein's valve only properly meters when the piston bottoms out on the user preselected stop position.

In summary, Klein teaches using a displaceable piston, "lightly biased" by a spring towards a closed position, to bottom out at an operator preselected fixed stop in operation, which stop determines the ratio of the proportioning (e.g., 3%, 6% or 10%.) Given the structure of Klein's device, the pressure drop effected is a function of upstream supply pressure and downstream back pressure (or the number of devices open downstream,) to name two prominent factors. Klein's design does not maintain any fixed or preselected "pressure drop" if, when and as these two factors vary. In the Brief and Transitory Opening Period, the piston is not taught, suggested or disclosed to maintain or target any preselected or fixed pressure drop across the orifice. Furthermore, metering is not taught to take place during this transitory period for Klein. Fluid pressures must overcome the lightly biased-closed position of Klein's piston and move the piston

to its stopped position, the stopped position being preselectable, in order to accomplish Klein's metering purpose.

Again, the point or purpose of Klein's mixing valve is to meter for different concentrate products, products that call for being mixed in different proportions or ratios. The proper ratio is setable by selecting a stop. On col. 7, lines 19 – 21, Klein makes clear that the degree of piston displacement corresponds to the ratio selected, i.e. 3%, 6%, 10% or the like. The piston bottoms out on the stop that has been preselected for that ratio. Thus, the piston is not taught to be used to maintain a preselected constant pressure drop.

Issues 2 and 3 – Sub-Issue C: does Klein teach, suggest or enable <u>automatically</u> varying a foam proportioning orifice in order to meter in accordance with fire fighting fluid flow rate, as per claim 20?

Klein does not teach or disclose "automatically" varying a foam proportioning orifice. Familiarity with Klein from the above discussion will be presumed. In Stage I Klein's piston moves from its slightly biased closed position to its full open position bottoming out upon the shoulder or stop selected by the operator. The bottoming out position determines the opening of the foam proportioning orifice in order to meter in accordance with fire fighting fluid flow rate. Klein teaches no automatic varying of this foam proportion orifice. It varies in accordance with an operator preselected stop or shoulder.

In regard to Transitory Stage II, the foam proportioning orifice simply opens to its preset position. It does not automatically vary and it is not taught to be properly metering.

Issues 2 and 3 – Sub-Issue D: does Klein teach or suggest <u>automatically</u> adjusting… to control discharge pressure (or pressure drop), as per claims 20 and 42?

Klein does not teach or suggest automatically adjusting to control discharge pressure or pressure drop. Klein does not teach or suggest controlling discharge pressure or pressure drop. Klein's preselected stop or shoulder can affect discharge pressure or pressure drop but it does not control discharge pressure or pressure drop. Klein contains no teaching of any automatic adjusting to control discharge pressure or pressure drop.

Issues 2 and 3 – Sub-Issue E: does Klein disclose that a varying fire fighting fluid orifice that acts as a fire fighting fluid flow rate indicator, as per claim 14?

Klein does not teach or suggest that the varying fire fighting fluid orifice during the Brief and Transitory Period of opening or closing in Stage II acts as a fire fighting flow rate indicator. Given the unstable nature of flow during Opening and Closing phases, including cavitation, it is

neither taught nor obvious that Klein's varying fire fighting fluid orifice during a Brief and Transitory Period of opening would be a flow rate indicator.

Issue 3 – Sub-Issue F: whether it would have been obvious to use the valve of Klein as a "terminal member" (e.g. nozzle,) as recited in claim 20.

The Examiner points to no suggestion or motivation to adapt Klein's valve to become a "terminal member" and thereby to become a fire fighting nozzle. Klein's valve, in fact, is structured in order to be introduced to the suction or pressure side of a pump. It is taught to be structured large enough to handle full pump capacity. Klein contains no teaching in regard to structuring the discharge orifice of his valve in order to properly squeeze down to recover pressure required for a discharge orifice nor for any structure to shape a discharge stream or to avoid turbulent flow through the device. Furthermore, given Klein's valve design, the foam concentrate would likely never mix with the water if Klein's valve were made a terminal device since, according to Klein's design, if the valve were turned into a terminal member, the foam concentrate would appear to be discharged inside of and not mixed with the water.

Applicants have made a diligent effort to place the claims in condition for allowance. Claims 16 and 17 are enabled. The cited reference does not render any claims anticipated or obvious.

This application is now considered to be in condition for allowance and such action is earnestly solicited.

Respectfully Submitted,

6/15/4
Date

Sue Z. Shaper
Attorney/Agent for Applicant(s)
Reg. No. 31663

Sue Z. Shaper
1800 West Loop South, Suite 750
Houston, Texas 77027
Tel. 713 550 5710

Appendix A
Claims on Appeal

12. A method for proportioning a fire fighting chemical into variably flowing fire fighting fluid , comprising:

adjusting a fire fighting fluid orifice in a fire fighting fluid conduit to maintain a predetermined pressure drop across the orifice as fire fighting fluid flow rate through the conduit varies;

varying a fire fighting foam concentrate orifice in concert with the adjustment of the fire fighting fluid orifice; and

supplying fire fighting foam concentrate through the concentrate orifice into the fire fighting fluid proximate a pressure drop such that a ratio of the foam concentrate proportioned into the fire fighting fluid flowing through the conduit, to the fluid, remains approximately constant.

13. The method of claim 14 wherein varying a fire fighting fluid orifice includes adjusting a lateral movement of a baffle within the conduit

14. A method for automatically proportioning foam into variably flowing fire fighting fluid, comprising:

varying a fire fighting fluid orifice in a conduit to maintain a preselected pressure drop in the conduit and wherein the varying fire fighting fluid orifice acts as a fire fighting fluid flow rate indicator;

varying a foam concentrate orifice, at a rate calibrated in concert with variations of the fire fighting fluid orifice; and

discharging foam concentrate through the variable foam concentrate orifice proximate a low pressure zone created by a pressure drop at an approximately constant ratio to the fluid.

15. The method of claim 14 that includes varying the fire fighting fluid orifice based upon a spring resisting fire fighting fluid pressure in the conduit.

16. The method of claim 14 wherein varying the fire fighting fluid orifice includes setting a pilot valve to maintain a fixed pressure drop across the orifice from among a range of preselectable fixed pressure drops.

17. The method of claim 16 wherein the pilot valve is biased by spring.

18. The method of claim 14 wherein varying a fire fighting fluid orifice includes adjusting a lateral movement of a piston within the conduit.

20. A method comprising:

automatically adjusting a fire fighting nozzle to control discharge pressure;

self-educting fire fighting foam concentrate into the nozzle using a portion of a fire fighting fluid flowing at at least 500 gpm through the nozzle; and

automatically varying a foam proportioning orifice in order to meter foam concentrate self-educted into the nozzle in accordance with fire fighting fluid flow rate through the nozzle

39. Method for proportioning foam concentrate into a variable flow fire fighting fluid conduit, comprising:

placing pressurized foam concentrate in communication with pressurized fire fighting fluid variably flowing through a conduit;

arranging a pilot valve sensitive to flow rate of the fire fighting fluid in the conduit;

adapting the pilot valve to adjust a flow rate of foam concentrate into the fire fighting fluid such that the foam concentrate is proportionally metered into the variably flowing fire fighting fluid;

adapting the pilot valve to vary an obstruction to flow of fire fighting fluid in the conduit; and

varying the obstruction by the pilot valve to maintain a fixed pressure drop in the fire fighting fluid conduit.

40. The method of claim 39 that includes adapting the pilot valve to vary an obstruction to flow of fire fighting fluid in the conduit.

41. The method of claim 39 that includes measuring pressure drop around the obstruction.

42. A method comprising:

automatically adjusting an obstruction in a fire fighting fluid conduit flowing at least 500 gpm to maintain a preselected pressure drop;

arranging a pilot valve sensitive to fire fighting fluid flow rate in the conduit; and

proportionally metering, using the pilot valve, a foam concentrate into the conduit proximate the pressure drop.

43. The method of claim 39 that includes adjusting a flow rate of foam concentrate by adjusting an orifice in a foam concentrate flow conduit.

Appendix A
Withdrawn Claims

1. A system for proportioning fire fighting foam concentrate into variably flowing fire fighting fluid passing through a conduit, comprising:

a conduit for fire fighting fluid having a variable orifice therein, the variable orifice defined at least in part by a first adjusting element, the element in communication with and structured to adjust at least in part in accordance with pressure differential of fluid in the conduit;

a fire fighting foam concentrate passageway connected to a source of fire fighting foam concentrate and having a variable concentrate orifice, the concentrate passageway in fluid communication with fluid passing through the conduit, the variable concentrate orifice at least in part defined by a second adjusting element;

the first and second adjusting elements connected so as to adjust in concert and such that fluid pressure differential acting to adjust the first element enlarges both orifices at a precalibrated rates.

2. The apparatus of claim 1 wherein the first adjusting element includes a baffle in the conduit.

3. The apparatus of claim 2 wherein the second adjusting element includes a baffle stem in the conduit, the stem connected to the baffle.

4. The apparatus of claim 1 wherein the first adjusting element is structured to adjust the fire fighting fluid orifice to maintain a preselected pressure drop across the orifice.

5. The apparatus of claim 4 wherein the foam concentrate passageway is structured to discharge foam concentrate into the fire fighting fluid proximate the pressure drop.

6. The apparatus of claim 1 wherein the fire fighting fluid conduit includes an inner conduit and the foaming concentrate orifice includes a variable slot in fluid communication with the inner conduit.

7. The apparatus of claim 6 wherein the inner conduit is structured and located such that a portion of fire fighting fluid passes through the inner conduit.

8. The apparatus in claim 1 wherein the foaming concentrate passageway is in fluid communication with a source of foaming concentrate.

9. The apparatus of claim 8 wherein the source of foaming concentrate is pressurized over atmospheric.

10. The apparatus of claim 8 wherein the source of foaming concentrate is at ambient pressure.

11. The apparatus of claim 1 wherein the fire fighting fluid variable orifice comprises a nozzle orifice.

19. Apparatus, comprising:

an automatic pressure regulating self-educting foam/fog fire fighting nozzle including an automatically varying fire fighting foam concentrate proportioning orifice,

the nozzle structured to flow at least 50 gpm; and

the orifice in fluid communication with a source of fire fighting foam concentrate.

21. Proportioning apparatus for fire fighting systems, comprising:

a housing having an adjustable water passageway adapted to be connected to a source of pressurized water and creating a pressure drop in the system;

an adjustable fire fighting foam concentrate passageway adapted to be connected to a source of fire fighting foam concentrate and communicating with water from the passageway proximate a pressure drop;

the foam passageway connected to the water passageway to adjust in concert; and

a pilot valve in fluid communication with water pressure upstream and downstream of the adjustable water passageway, the valve adapted to influence the adjustment of the water passageway toward maintaining pre-selected pressure drop.

22. The apparatus of claim 21 wherein the adjustable water passageway includes a dual acting baffle piston, the baffle piston having a first side in fluid communication with upstream water pressure and the baffle piston having a second side in fluid communication through a pilot valve with, alternately, upstream water pressure and downstream water pressure.

23. The apparatus of claim 22 wherein the dual action baffle piston is structured to present unequal surface areas to pressure in opposing directions.

24. The method of claim 39 that includes

placing a pressurized fire fighting foam concentrate conduit in fluid communication with a pressurized fire fighting fluid conduit remote from a fire fighting fluid discharge nozzle; and

varying a first orifice in the fire fighting fluid conduit to maintain a pre-determined pressure drop in said conduit of a value less than a fire fighting fluid discharge pressure drop.

25. The method of claim 24 wherein the first orifice is varied to maintain a pressure drop of less than approximately 25psi.

26. The method of claim 25 wherein the first orifice is varied to maintain a pressure drop of approximately 15psi.

27. The method of claim 24 that includes pressurizing foam concentrate into the fire fighting fluid at a pressure distinct from the pressurizing of the fire fighting fluid conduit.

28. The method of claim 24 that includes varying a first orifice to maintain a relatively constant pressure drop in the fire fighting fluid conduit using a pilot valve.

29. The method of claim 24 that includes pressurizing foam concentrate in the foam concentrate conduit at a level commensurate with the pressurizing of the fire fighting fluid in the fire fighting fluid conduit.

30. The method of claim 25 that includes proportioning foam concentrate into the fire fighting fluid proximate the pressure drop.

31. The method of claim 25 that includes utilizing a pilot valve to create a deluge valve.

32. The method of claim 24 that includes educting, at least in part, foam concentrate into the fire fighting fluid.

33. The apparatus of claim 44 that includes

a pressurized fire fighting foam concentrate conduit in fluid communication with a pressurized fire fighting fluid conduit remote from a fire fighting fluid discharge nozzle; and

a pilot valve in fluid communication with the fire fighting fluid conduit, structured to vary a first orifice in the fire fighting fluid conduit to maintain a pre-determined pressure drop in said conduit of a value less than a fire fighting fluid discharge pressure drop.

34. The apparatus of claim 33 wherein the pilot valve is structured to maintain a pressure drop of less than approximately 25psi.

35. The apparatus of claim 33 wherein the pilot valve is structured to maintain a pressure drop of approximately 15psi.

36. The method of claim 33 that includes a pilot valve structured to vary a first orifice to maintain a relatively constant pressure drop in the fire fighting fluid conduit.

37. The apparatus of claim 33 that includes the foam concentrate conduit in fluid communication with the fire fighting fluid conduit proximate the pressure drop.

38. The apparatus of claim 33 that includes a pilot valve structured to create a deluge valve.

44. Apparatus for proportioning foam concentrate into a variable flow fire fighting fluid conduit, comprising:

a pressurized foam concentrate conduit in fluid communication with a pressurized fire fighting fluid conduit;

a pilot valve in fluid communication with the fire fighting fluid conduit, structured to detect variation in flow rate of the fire fighting fluid in the conduit; and

an orifice metering foam concentrate into the fire fighting fluid, structured for adjustment by the pilot valve.